National Advisory Committee for Aeronautics

Research Abstracts

NO. 61

APRIL 13, 1954

CURRENT NACA REPORTS

NACA TN 3023

RESULTS OF EDGE-COMPRESSION TESTS ON
STIFFENED FLAT-SHEET PANELS OF ALCLAD
AND NONCLAD 14S-T6, 24S-T3, AND 75S-T6
ALUMINUM ALLOYS. Marshall Holt, Aluminum
Company of America. April 1954. 18p. diagrs.,
photos., 2 tabs. (NACA TN 3023)

This investigation was made to augment data pre-
viously obtained on the compressive strengths of
stiffened flat-sheet panels to include the range where
ultimate strengths approach the compressive yield
strengths of the materials. The sheet materials used
were alclad and nonclad 14S-T6, 24S-T3, and 75S-T6.
The ultimate strengths of the panels tested varied
from 93.3 to 118.0 percent of the compressive yield
strengths of the materials from which they were con-
structed. The ultimate strengths of these panels
appear to be limited by the strengths of the rivets.
Higher ultimate strengths might have resulted from
the use of larger or stronger rivets or a smaller
rivet spacing.

NACA TN 3070

EFFECTS OF PANEL FLEXIBILITY ON NATURAL
VIBRATION FREQUENCIES OF BOX BEAMS.
Bernard Budiansky and Robert W. Fralich. March
1954. 55p. diagrs. (NACA TN 3070)

Effects of local panel oscillations on bending and
torsional vibrations of box beams with flexible covers
and webs are investigated. Theoretical analyses of
simplified models are made in order to shed light on
the mechanism of coupling between local and overall
vibrations and to derive results that can be used to
estimate the coupling effects in box beams.

NACA TN 3071

THEORETICAL SUPERSONIC FORCE AND MOMENT
COEFFICIENTS ON A SIDESLIPPING VERTICAL-
AND HORIZONTAL-TAIL COMBINATION WITH SUB-
SONIC LEADING EDGES AND SUPERSONIC TRAIL-
ING EDGES. Frank S. Malvestuto, Jr. March 1954.
69p. diagrs., 2 tabs. (NACA TN 3071)

Formulas are obtained by means of linearized flow
theory for the lateral force due to sideslip, the
yawing moment due to sideslip, and the rolling
moment due to sideslip for a tail arrangement com-
posed of a vertical triangular surface attached to a
horizontal triangular surface. The leading edges of
the surfaces are subsonic; the trailing edges, super-
sonic. A series of design charts are presented for
rapid estimates of the stability derivatives con-
sidered.

NACA TN 3077

THE EFFECT OF DYNAMIC LOADING ON THE
STRENGTH OF AN INELASTIC COLUMN. William
A. Brooks, Jr. and Thomas W. Wilder, III. March
1954. 29p. diagrs., 2 tabs. (NACA TN 3077)

The maximum loads of idealized inelastic H-section
columns whose pinned ends approach each other at a
constant rate are presented. The solutions indicate
that as the rate of end displacement becomes smaller
the dynamic buckling solutions approach the static
solution as a lower limit. For all rates of end dis-
placement investigated the static maximum load may
be employed as a conservative estimate of the maxi-
n.um column load.

NACA TN 3079

THE HYDRODYNAMIC CHARACTERISTICS OF
MODIFIED RECTANGULAR FLAT PLATES HAVING
ASPECT RATIOS OF 1.00 AND 0.25 AND OPERAT-
ING NEAR A FREE WATER SURFACE. Kenneth L.
Wadlin, John A. Ramsen and Victor L. Vaughan, Jr.
March 1954. 64p. diagrs., photos. (NACA TN 3079)

Results are presented from an investigation of the
hydrodynamic forces and moments acting on modified
rectangular flat plates with aspect ratios of 1.00 and
0.25 mounted on a single strut and operating near the
free water surface. A simplified method of obtaining

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THE REPORT TITLE AND AUTHOR.

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the lift characteristics in unseparated flow at large depths is presented. This method shows very good agreement with the data. The experimental effects of changing the angle of attack, depth of submersion, and aspect ratio are presented. The effects of cavitation and two different types of high-angle leading-edge separation are also presented.

NACA TN 3081

THE ZERO-LIFT DRAG OF A 60° DELTA-WING—BODY COMBINATION (AGARD MODEL 2) OBTAINED FROM FREE-FLIGHT TESTS BETWEEN MACH NUMBERS OF 0.8 AND 1.7. Robert O. Piland. April 1954. 11p. diagrs., 2 tabs. (NACA TN 3081)

The zero-lift drag of a 60° delta-wing—body combination (designated AGARD model 2) has been determined by free-flight tests of two models between Mach numbers of 0.8 and 1.7. These Mach numbers correspond to Reynolds numbers, based on body length, of 4×10^6 and 12×10^6, respectively. An estimate of the drag of the configuration was made by summing the estimates of the drag of the various components. The agreement between measured and estimated drag is good.

NACA TN 3082

EXPERIMENTAL INVESTIGATION OF THE PURE-BENDING STRENGTH OF 75S-T6 ALUMINUM-ALLOY MULTIWEB BEAMS WITH FORMED-CHANNEL WEBS. Richard A. Pride and Melvin S. Anderson. March 1954. 30p. diagrs., photo., tab. (NACA TN 3082)

Experimental results are presented for the pure-bending strength of 53 multiweb beams of various proportions. The beams were fabricated from 75S-T6 aluminum-alloy sheet material and had channel-type webs which had been cold formed with bend radii of four times the web thickness. Local and wrinkling modes of buckling were observed prior to failure. All failures occurred with the formation of a trough in the compression skin extending across the web attachment flanges. The stress levels achieved at buckling and failure are discussed in terms of existing theory. Based upon the failure stresses, design charts are presented which permit rapid selection of the most efficient proportions for given values of an appropriate structural index.

NACA TN 3142

A FURTHER INVESTIGATION OF THE EFFECT OF SURFACE FINISH ON FATIGUE PROPERTIES AT ELEVATED TEMPERATURES. Robert L. Ferguson. March 1954. 27p. diagrs., photos., 3 tabs. (NACA TN 3142)

An investigation was conducted to evaluate the effects of surface roughness on fatigue properties of low carbon N-155 alloy with a grain size of A.S.T.M. 6 and of S-816 alloy with a grain size of A.S.T.M. 6 to 7. Fatigue studies were conducted at 80°, 1200°, 1350°, and 1500° F. In addition, an investigation of the effect of surface abrasion upon the character of residual stresses and of the effect of time and temperature upon the relief of these stresses was conducted. Compressive stresses were produced at right angles to the direction of abrasion. These residual compressive stresses, if of sufficient magnitude, in the surface of fatigue specimens improved fatigue strength at low temperatures. At elevated temperatures, however, these beneficial surface compressive effects were relieved and only the detrimental stress concentration effects produced by abrasion remained and reduced fatigue strength.

NACA TN 3144

COEFFICIENT OF FRICTION AND DAMAGE TO CONTACT AREA DURING THE EARLY STAGES OF FRETTING. II - STEEL, IRON, IRON OXIDE, AND GLASS COMBINATIONS. John M. Bailey and Douglas Godfrey. April 1954. 26p. diagrs., 4 tabs. (NACA TN 3144)

Experiments were conducted to study the early stages (up to 400 cycles) of fretting of steel-steel combinations at constant frequency, amplitude, load, and humidity. Pure iron, glass, and iron oxide powder compacts were used in supplementary experiments. The results of microscopic observation of the contact area, chemical analyses of fretting debris, and measurement of coefficient of friction are presented and lead to these conclusions: 1. Fretting starts with severe adhesion. The adhesion varies with the material combination, but is of primary importance because it precedes and initiates the other phenomena observed. 2. In the early stages of fretting, several other wear phenomena in addition to adhesion occur: plowing by protruding transferred material; formation of metallic and oxide debris; formation of films by compacting small particles into clearances in the contact area.

NACA TM 1362

ON THE SOUND FIELD OF A POINT-SHAPED SOUND SOURCE IN UNIFORM TRANSLATORY MOTION. (Über das Schallfeld einer gleichförmig-translatorisch bewegten punkförmigen Schallquelle). H. Hönl. April 1954. 44p. diagrs. (NACA TM 1362. Trans. from Annalen der Physik, issue 5, v. 43, 1943, p. 437-464).

A rigorous analysis presented of the excitation of sound by point sources moving in uniform translatory motion at subsonic or supersonic velocities through a two- or three-dimensional medium at rest. The construction of surfaces of constant phase is based upon Huyghens' principle in such a manner that the propagation in the medium at rest of the elementary waves emanating from the sound source is independent of the momentary state of motion of the sound source; hence, characteristic traits of the sound propagation may be understood even on the basis of simple geometric constructions.

NACA TM 1367

HEAT TRANSFER, DIFFUSION, AND EVAPORATION. (Wärmeübergang, Diffusion und Verdunstung). Wilhelm Nusselt. March 1954. 37p. diagrs. (NACA TM 1367. Trans. from Zeitschrift für angewandte Mathematik und Mechanik, v. 10, no. 2, April 1930, p. 105-121).

The general similarity of heat and mass transfer (diffusion) processes is discussed, with particular reference to the lack of complete identity of the relations governing the two phenomena. It is indicated that, for example, the boundary conditions in the two cases at the surface of a body will not be the same. The correct equation of diffusion is given for various simple cases. Generalized relations for combined heat and mass transfer are then evolved for particular situations, comparisons being made among several different approaches to the problem. Finally, the effect of a buoyancy force field on the generalized relations is considered, with special reference to the evaporation of water.

NACA RM E54B01

TOOTH-TYPE NOISE-SUPPRESSION DEVICES ON A FULL-SCALE AXIAL-FLOW TURBOJET ENGINE. Edmund E. Callaghan, Walton Howes and Warren North. March 1954. 16p. diagrs., photos. (NACA RM E54B01)

A study of two jet-noise-suppression devices consisting of teeth projecting into the air stream was conducted on a current axial-flow turbojet engine. The sound fields obtained with both noise-suppression devices were similar and, when compared with a standard nozzle, showed a reduction in maximum sound pressure level downstream of the jet and increased levels on the sides and rear. The reduction in maximum sound pressure level was only 2 decibels, and the total radiated power from the toothed and standard nozzles was almost identical (±1 db). It was concluded, therefore, that the toothed devices investigated do not represent a satisfactory solution of the jet-noise problem.

BRITISH REPORTS

N-28936[*]

Aeronautical Research Council (Gt. Brit.) THE 9 x 3 IN. INDUCED-FLOW HIGH-SPEED WIND TUNNEL AT THE NATIONAL PHYSICAL LABORATORY. D. W. Holder and R. J. North. 1953. 23p. diagrs., photos., 9 tabs. (ARC R & M 2781. Formerly ARC 12,387; TP 285)

A 9 x 3 inch high-speed wind tunnel driven by a compressed-air injector has been built in the Aerodynamics Division of the National Physical Laboratory. The tunnel operates at roughly atmospheric stagnation pressure and has so far been used to give Mach numbers up to 1.8. The general arrangement of the tunnel and the preliminary calibration, which is generally satisfactory, are described.

N-28937[*]

Aeronautical Research Council (Gt. Brit.) BRITISH PERFORMANCE REDUCTION METHODS FOR MODERN AIRCRAFT. D. Cameron. 1953. 32p., diagrs., 5 tabs. (ARC R & M 2447; ARC 6445. Formerly AAEE/Res/170)

The methods of reduction of performance measurements to standard conditions applicable to aircraft with highly supercharged engines and constant-speed propellers are the subject of this report. The theory of the agreed methods is summarized in brief form, tables are given from which the necessary charts can be constructed, and the practical method of applying the corrections is described. The report does not include methods appropriate to certain aircraft and engines of later development (turbosuperchargers, turbine engines, and high-speed aircraft).

N-28938[*]

Aeronautical Research Council (Gt. Brit.) THE THEORETICAL EFFECT OF FLIGHT PATH ANGLE ON THE LATERAL STABILITY AND RESPONSE OF AN AIRCRAFT. E. M. Frayn and M. V. Parnell. 1954. 28p. diagrs., 8 tabs. (ARC R & M 2529; ARC 9360. Formerly RAE Aero 2097)

The response of a typical aircraft of the dive-bomber class to various disturbances has been calculated at four angles of dive covering the range 0^0 to 90^0 and for four pairs of values of l_v, n_v. The most notable effect on stability is the marked increase in spiral damping with increasing dive angle at the same T.A.S. This has little effect on the response, since in most components, this mode is scarcely excited. For dive angles up to 30^0, the variations in response are so slight as to be negligible, while for larger angles of dive, the variation is small for the first 2 airsecs. Calculations of response in level flight, which slightly underestimate the response in a dive, can thus be assumed to give a sufficiently accurate picture of the behavior at small flight path angles for most requirements.

N-28939*

Aeronautical Research Council (Gt. Brit.)
INVESTIGATION OF LATERAL AND DIRECTIONAL
BEHAVIOUR OF SINGLE ROTOR HELICOPTER
(HOVERFLY MK. I). J. Zbrozek. 1953. 20p.
diagrs., tab. (ARC R & M 2509; ARC 11,701.
Formerly RAE Aero 2268)

This note gives an elementary theory of the lateral and directional stability and control of the single rotor helicopter with particular reference to the Sikorsky R4-B. The results of the analysis give good qualitative agreement with flight tests. Preliminary flight tests show higher damping and higher frequency of oscillations than predicted by theory. A theoretical investigation of the lateral stability of the helicopter by Hohenemser, although made for a side-by-side twin-rotor helicopter, is in good agreement with the results of this note.

N-28940*

Aeronautical Research Council (Gt. Brit.)
EFFECTS OF AIR HUMIDITY IN SUPERSONIC WIND
TUNNELS. Julius Lukasiewicz and J. K. Royle.
1953. 35p. diagrs., photos., 7 tabs. (ARC R & M
2563; ARC 10,977; ARC 12,374. Formerly RAE
Aero 2211; SD 20; Tech. Note Aero 1982; SD 89)

The available theoretical and experimental information on condensation of water vapor in the supersonic flow of air is reviewed and the influence of condensation on operation of supersonic tunnels is considered. The mechanism of condensation in supersonic flow is of molecular nature and does not depend on the presence of solid condensation nuclei in the air. As estimated by Oswatitsch and confirmed by experimental results, the condensation in supersonic flow of air is primarily a function of the adiabatic super-cooling ΔT_k to ad which determines the conditions at which the condensation shock occurs. For medium-sized supersonic tunnels (say 1-foot square working section) the adiabatic supercooling is of the order of 50^0 C. For most test purposes, it is essential to eliminate the detrimental effects of condensation on flow distribution in the tunnel working section. The usual method is to use highly dried air, and the question of the required dryness is considered. Other methods, which do not rely on the dryness of air, are discussed. It is shown that by increasing stagnation temperature condensation can be avoided usually only at Mach numbers smaller than 1.5. Alternatively, condensation can be eliminated from the tunnel nozzle by pre-expansion in an auxiliary nozzle, as verified experimentally.

N-28941*

Aeronautical Research Council (Gt. Brit.)
SUPERSONIC THEORY FOR OSCILLATING WINGS
OF ANY PLAN FORM. W. P. Jones. 1953. 11p.
diagrs. (ARC R & M 2655. Formerly ARC 11,559;
0.730; FM 1254)

A theory for thin wings of any plan form describing simple harmonic oscillations of small amplitude in a supersonic airstream is developed. It is based on the use of the generalized Green's Theorem in conjunction with particular solutions which vanish over the characteristic cone with vertex at any point in the field of flow. The theory can be used to calculate the aerodynamic forces acting on fluttering wings when the modes of distortion are known.

N-28942*

Aeronautical Research Council (Gt. Brit.)
FLIGHT TESTS ON SWINGING DURING TAKE-OFF
ON A SINGLE-ENGINED FIGHTER-BOMBER
(TYPHOON Ib). W. Stewart. 1953. 29p. diagrs.,
tab. (ARC R & M 2660; ARC 11,725. Formerly
RAE Aero 2261)

Values of the aerodynamic side forces and yawing moments during take-off are compared with wind-tunnel measurements. Various methods of estimating the rudder angles required to trim during take-off are compared also. Results show very good agreement with wind-tunnel tests. It was not possible to obtain smooth application of the rudder and records show considerable over-correction by the pilot. This over-correction by the pilot is quite general and as a result some considerable margin of control must be available in excess of that required for trim.

N-28943*

Aeronautical Research Council (Gt. Brit.)
CORRECTIONS FOR SYMMETRICAL SWEPT AND
TAPERED WINGS IN RECTANGULAR WIND TUN-
NELS. W. E. A. Acum. 1953. 33p. diagrs., 41
tabs. (ARC R & M 2777. Formerly ARC 13,050;
Perf. 649; ARC 14,159; Perf. 815)

In the case of wings with straight leading and trailing
edges, the interference upwash due to the images of
the wing in the wind-tunnel walls may be determined
in terms of three functions of the parameters defining
the size of the wing and tunnel. These functions have
been tabulated and used to estimate the effect on C_L
and C_M, for wings of a variety of sizes and shapes.
The variation of mean induced incidence with sweep
and taper was found to be small. A formula is given
for computing the residual correction to C_M for
each special case.

N-28944*

Aeronautical Research Council (Gt. Brit.)
THE PRESSURE DISTRIBUTION, AT SUPERSONIC
SPEEDS AND ZERO LIFT, ON SOME SWEPT-BACK
WINGS HAVING SYMMETRICAL SECTIONS WITH
ROUNDED LEADING EDGES. G. M. Roper. 1954.
20p. diagrs. (ARC R & M 2700; ARC 12,364.
Formerly RAE Aero 2312)

Formulas are found for the pressure distribution at
supersonic speeds and at zero incidence for certain
symmetrical surfaces of small finite thickness, with
sweptback leading edges. The surfaces are set
symmetrically to the wind direction. The solution is
only valid if the surfaces lie wholly within the Mach
cone of the apex. Solutions are applied to give the
pressure distribution for wings of small finite thick-
ness with straight leading edges and a hyperbolic or
parabolic trailing edge. Some calculations for wing
drag have also been made for sweptback wings.

N-28945*

Aeronautical Research Council (Gt. Brit.)
AN APPROXIMATE SOLUTION OF THE COMPRESS-
IBLE LAMINAR BOUNDARY LAYER ON A FLAT
PLATE. R. J. Monaghan. 1953. 24p. diagrs., 2
tabs. (ARC R & M 2760; ARC 12,963. Formerly
RAE Tech. Note Aero 2025, sup. 96)

The flat plate problem has received the attention of
many workers, but as yet all solutions have been
purely numerical for special cases. In this paper,
an approximate, analytical solution is presented
which is more general and has the merits of simplic-
ity. The equations are algebraic in form whereas
previous results have involved complex numerical
integrations for individual cases. The solution given
shows clearly the effects of changes in working con-
ditions.

N-30183*

Aeroplane and Armament Experimental Establish-
ment (Gt. Brit.) FLIGHT TESTS OF A YOUNGMAN-
HUGHES STALL WARNING DEVICE ON A NENE
VIKING AIRCRAFT. D. A. Lang. November 23,
1953. 22p. diagrs., 4 tabs. (AAEE/Inst/91)

A Youngman-Hughes stall warning device was tested
on a Nene Viking. The device depends for operation
on the changes in pressure distribution around the
lower surface of the leading edge of the wing as the
stall is approached. The installation operated satis-
factorily. Though it was tested on the Nene Viking,
the device should be applicable to other aircraft. It
should give suitable warning of the low altitude, slow
speed stall, that is for the condition where adequate
warning is imperative.

N-30184*

Royal Aircraft Establishment (Gt. Brit.)
THE DETERMINATION OF SIZE ON GLASS
FABRICS: A STATISTICAL ANALYSIS. A. A. Fyall
and E. W. Russell. December 1953. 21p. 23 tabs.
(RAE Tech. Note Chem. 1212)

The apparently simple determination of organic size
on glass fabrics for the preparation of polyester
laminates was examined in a statistical experiment
after interlaboratory disagreements. Five observers
at three different laboratories examined six fabric
samples including both low and high alkali glasses.
The results are analyzed and recommendations are
made for improving the test procedure.

UNPUBLISHED PAPERS

N-29532*

RECORDED PRESSURE DISTRIBUTION IN THE
OUTER PORTION OF A TORNADO VORTEX.
William Lewis and Porter J. Perkins. (Reprint
from Monthly Weather Review, v. 81, no. 12,
December 1953, p. 379-385)

This tornado took place on June 8, 1953 and passed
through a portion of the Lewis Flight Propulsion
Laboratory. Eight barographs were in operation at
various locations within the laboratory at the time.
Records are presented from nine barographs located
in a small area close to the path of a tornado. The
pressure profile in the range from 720 to 2,300 feet
from the path of the tornado center as determined
from the barograph records was found to be in good
agreement with calculations based on a simple model
consisting of a frictionless vortex with in-flow.

N-29586*

Clarkson College of Technology.
THE SIZE AND SHAPE OF COLLOIDAL PARTICLES
BY LIGHT SCATTERING. Milton Kerker.
December 31, 1953. 58p. diagrs., photos., 10 tabs.
(Clarkson College of Technology)

Results are given of an experimental investigation of
the scattering and absorption of light by a system of
nonspherical particles. The sol used was the hydro-
sol of vanadium pentoxide. Besides, being non-
spherical, these particles are further characterized
by their appreciable absorption of light. The sols
were also studied by electron microscopy in order to
correlate the scattering and absorption with the size
and shape of the particles.

N-29587*

HEAT CONDUCTION IN LAMINATED SPHERICAL
AND CYLINDRICAL BODIES. (Wärmeleitung in
geschichteten kugel- und zylinderkörpern). V.
Vodicka. 24p. (Trans. from Schweizer Archiv,
Annales Suisses, v. 16, no. 10, October 1950,
p. 297-304).

The problem of unsteady heat flow within spherical
and cylindrical bodies each consisting of an indefinite
number of concentric spherical or cylindrical
laminae is solved. The postulated conditions are:
that the successive laminae are in perfect thermal
contact; that the innermost surface (which may have
a zero radius) is impermeable to heat; that a fixed,
finite heat-transfer coefficient exists at the outer
surface; and that an arbitrary known temperature
distribution exists in the body initially. All of the
necessary mathematical relations are worked out,
including relations required to determine the coeffi-
cients appearing in the solution equations, but no
numerical examples are given.

N-29598*

VORTEX FLOW IN AXIAL MACHINES. (Écoulements
tourbillonnaires dans les machines axiales). R.
Siestrunck and J. Fabri. 83p. diagrs. (Trans. from
Office National d'Études et de Recherches
Aéronautiques. Pub. 45).

Properties of rotational motion in axial machines and
of an incompressible fluid in a cylindrical duct are
discussed. The stream function describing the evolu-
tion of the fluid motion is used systematically. The
Prandtl reduction of the blades to lifting lines is re-
tained. Several linearized solutions for a compressi-
ble fluid are given which show that the general equa-
tions for incompressible flow, linearized, do not lead
to inextricable calculations. Examples given are for
cylindrical and convergent ducts.

DECLASSIFIED   REPORTS

NACA RM E50D10

AERODYNAMIC CHARACTERISTICS OF NACA
RM-10 MISSILE IN 8- BY 6-FOOT SUPERSONIC
WIND TUNNEL AT MACH NUMBERS FROM 1.49 TO
1.98. I - PRESENTATION AND ANALYSIS OF PRES-
SURE MEASUREMENTS (STABILIZING FINS RE-
MOVED). Roger W. Luidens and Paul C. Simon.
July 20, 1950. 53p. diagrs., photos. (NACA
RM E50D10) (Declassified from Confidential,
3/10/54)

Experimental investigation of flow about a slender
body of revolution (NACA RM-10 missile) alined and
inclined to a supersonic stream was conducted at
Mach numbers from 1.49 to 1.98 at a Reynolds num-
ber of approximately 30,000,000. Boundary-layer
measurements at zero angle of attack are correlated
with subsonic formulations for predicting boundary-
layer thickness and profile. Comparison of pressure
coefficients predicted by theory with experimental
values showed close agreement at zero angle of
attack and angle of attack except over the aft leeward
side of body. At angle of attack, pitot pressure
measurements in plane of model base indicated a
pair of symmetrically disposed vortices on leeward
side of body.

NACA RM L50L13

A FINITE-STEP METHOD FOR THE CALCULATION
OF SPAN LOADINGS OF UNUSUAL PLAN FORMS.
George S. Campbell. July 16, 1951. 34p. diagrs., 4
tabs. (NACA RM L50L13) (Declassified from
Confidential, 3/10/54)

The applicability of a finite-step method to the calcu-
lation of subsonic spanwise load distribution, lift-
curve slope, lateral center of pressure, and aerody-
namic center of unusual plan forms has been investi-
gated. Computing forms are presented to simplify
calculation of span loadings for conventional swept,
M plan-form, and W plan-form wings. Tables of the
downwash in the plane of a yawed vortex are pre-
sented. Span loadings have been compared with those
obtained by Falkner and Weissinger for several plan
forms. The effect of an extra vortex located near the
tip, the use of yawed vortices, and the number of
steps necessary are discussed in the light of calcu-
lated results.

NACA RM L51E29

CALCULATED AERODYNAMIC LOADINGS OF M,
W, AND Λ WINGS IN INCOMPRESSIBLE FLOW.
Franklin W. Diederich and W. Owen Latham.
August 30, 1951. 58p. diagrs., tab. (NACA
RM L51E29) (Declassified from Confidential,
3/10/54)

Presented are the results of theoretical incompress-
ible flow calculations of the spanwise lift distribu-
tions and some associated aerodynamic parameters
of 20 M, W, and Λ wings. These results are com-
pared with similarly calculated results for ordinary
swept and unswept wings.

NACA RM L51E31

PRELIMINARY EXPERIMENTAL INVESTIGATION
OF FLUTTER CHARACTERISTICS OF M AND W
WINGS. Robert W. Herr. August 8, 1951. 31p.
diagrs., photos., tab. (NACA RM L51E31) (De-
classified from Confidential, 3/10/54)

Results of nine experimental flutter tests are pre-
sented to give a comparison of the flutter character-
istics of wings having M and W type plan forms. A
technique is also presented whereby the natural vi-
bration mode shapes of the model wings are obtained
photographically.